



Level One

MODULE 29101-03 - WELDING SAFETY

- Transparencies
- Markers/chalk
- Blank acetate sheets
- Transparency pens
- Pencils and scratch paper
- Module Examinations
- Performance Profile Sheets
- Overhead projector and screen
- Whiteboard/chalkboard
- Appropriate personal protective equipment
- Various welding gloves
- Auto-darkening helmet
- Full-face supplied-air respirator (SAR)
- Samples of protective welding footwear
- Earmuffs and ear plugs

MODULE 29102-03 - OXYFUEL CUTTING

Overhead projector and screen
Transparencies
Blank acetate sheets
Whiteboard/chalkboard
Transparency pens
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Oxygen cylinder (with cap)
Fuel gas cylinder (with cap)
Regulators (oxygen and fuel gas)
Hose set
Combination cutting torch
One-piece cutting torch
Assorted torch nozzles (cutting, washing, gouging)
Cylinder cart
Motorized oxyfuel track cutter
Framing squares
Combination squares with protractor head
Tape measure
Soapstone
Penknife
Pliers
Chipping hammer
Friction lighter
Vendor cutting tip chart
Tip cleaners and file
Wrenches (torch, hose, and regulator)
Steel plate

- Thin (16 to 10 gauge)
- Thick (1/4 inch to 1 inch)

Module Examinations
Performance Profile Sheets

MODULE 29103-03 - BASE METAL PREPARATION

Overhead projector and screen Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Weld examples
Chipping hammer
Pliers
Tape measure
Soapstone
File
Framing square
Combination square with protractor head
Hand scrapers and wire brushes
Power grinder with grinding and wire brush attachments
Mechanical plate beveling equipment
Mechanical pipe beveling equipment
Oxyfuel cutting equipment
Motorized oxyfuel track cutter
Mild steel plate
Mild steel pipe
Module Examinations
Performance Profile Sheet

MODULE 29104-03 - WELD QUALITY

Transparencies

Markers/chalk

Blank acetate sheets

Transparency pens

Pencils and scratch paper

Module Examinations

Performance Profile Sheets

Overhead projector and screen

Whiteboard/chalkboard

Appropriate personal protective equipment

Welding samples showing:

- Porosity
- Inclusions
- Cracks
- Weld metal cracks
- Base metal cracks
- Incomplete joint penetration
- Incomplete fusion
- Undercut
- Arc strikes
- Spatter
- Unacceptable weld profiles

Undercut gauge

Butt weld reinforcement gauge

Fillet weld blade gauge set

Welding code examples

Examples of Welding Procedure Specifications and Procedure Qualification Records

Radiograph examples

Tested specimens of good and failed welds

MODULE 29105-03 - EQUIPMEN AND SETUP

- Transparencies
- Markers/chalk
- Blank acetate sheets
- Transparency pens
- Pencils and scratch paper
- Module Examinations
- Performance Profile Sheets
- Overhead projector and screen
- Whiteboard/chalkboard
- Appropriate personal protective equipment
- Welding cables
- Lugs and quick disconnects
- Workpiece clamps
- Electrode holders
- Chipping hammers
- Wire brushes
- Files
- Pneumatic weld flux chipper
- Pneumatic needle scaler
- Transformer welding machine
- Transformer-rectifier welding machine
- Motor generator welding machine
- Engine-driven generator welding machine and alternator

MODULE 29106-03 - ELECTRODES AND SELECTION

- Transparencies
- Markers/chalk
- Blank acetate sheets
- Transparency pens
- Pencils and scratch paper
- Module Examinations
- Performance Profile Sheets
- Overhead projector and screen
- Whiteboard/chalkboard
- Appropriate personal protective equipment
- Electrodes of various types
- Sample MSDS for an electrode

MODULE 29107-03 - BEADS AND FILLET WELDS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Sample electrodes
Carbon steel for practice coupons, 1/4" thick minimum
DC (or AC) welding machine
Welding bench with arm for position work
Oxyfuel cutting equipment
Welding shield or helmet
Grinders
Framing square
Soapstone
Tape measure
Pliers
Wire brush
Workpiece clamps
Chipping hammer
Electrode holder
Electrodes, E6010 and E7018 (or E6011 and E6013 for AC)
Friction lighter
Module Examinations
Performance Profile Sheets

MODULE 29108-03 - SMAW - GROOVE WELDS WITH BACKING

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Sample electrodes
Carbon steel for practice coupons, $\frac{1}{4}$ " thick minimum
DC (or AC) welding machine
Welding bench with arm for position work
Oxyfuel cutting equipment
Welding shield
Grinders
Framing square
Soapstone
Tape measure
Pliers
Friction lighter
Wire brush
Chipping hammer
Workpiece clamps
Electrode holder
Electrodes, $\frac{5}{32}$ and $\frac{3}{16}$ inch E7018 (or E6013 for AC)
Module Examinations
Performance Profile Sheets

MODULE 29109-03 - JOINT FIT-UP AND ALIGNMENT

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Module Examinations
Performance Profile Sheets
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Straightedges
Squares
Levels
Hi-Lo gauges
Hydraulic jacks, chain hoists, come-alongs
Strongbacks, clips, yokes, wedges
Plate alignment tools
Pipe jacks and rollers
Chain clamps, cage clamps, rim clamps
Small-diameter pipe clamping devices
Pipe pullers
Flange alignment tools
Carbon steel plate and pipe of various sizes

MODULE 29110-03 - OPEN V-GROOVE WELDS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Sample electrodes
Carbon steel for practice coupons, 1/4" thick minimum
DC (or AC) welding machine
Welding bench with arm for position work
Oxyfuel cutting equipment
Welding shield or helmet
Grinders
Framing square
Soapstone
Tape measure
Pliers
Friction lighter
Wire brush
Chipping hammer
Workpiece clamps
Electrode holder
Electrodes, E6010 and E7018 (or E6011 and E6013 for AC)
Module Examinations
Performance Profile Sheets

MODULE 29111-03 - OPEN-ROOT PIPE WELDS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Sample electrodes
Carbon steel pipe for practice coupons, 3" to 12" diameter Schedule 40 or Schedule 80
DC (or AC) welding machine
Welding bench with arm for position work
Pipe rollers
Oxyfuel cutting equipment
Welding shield or helmet
Grinders
Framing square
Soapstone
Tape measure
Friction lighter
Wire brush
Chipping hammer
Workpiece clamps
Electrode holder
Pliers
Electrodes, E6010 and E7018 (or E6011 and E6013 for AC)
Module Examinations
Performance Profile Sheets

Level Two

MODULE 29201-03 - WELDING SYMBOLS

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

AWS Standard A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination

Sample site quality standard

Sample fillet welds

Sample V-groove welds

Module Examinations

MODULE 29202-03 - READING WELDING DETAIL DRAWINGS

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Welding drawings

Module Examinations

Performance Profile Sheets

MODULE 29203-03 - SMAW – STAINLESS STEEL GROOVE AND PIPE WELDS

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Examples of stainless steel with carbide precipitation

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Cutting goggles

Welding bench with arm for position work

Oxyfuel cutting equipment

DC welding machine

Stainless steel, $\frac{3}{8}$ " thick minimum, or carbon steel plate, $\frac{1}{4}$ " to $\frac{3}{4}$ " thick, for practice coupons

Portable angle-head grinders

Framing square

Soapstone

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Chipping hammer

Workpiece clamps

Electrode holder

Stainless steel electrodes, $\frac{3}{32}$ " and $\frac{1}{8}$ ", compatible with the base metal being welded

Pipe for weld coupons: 3" to 12" Schedule 40 or Schedule 80 stainless or carbon steel pipe

Pipe alignment clamps

Pipe beveling equipment (optional)

Module Examinations

Performance Profile Sheets

MODULE 29204-03 - AIR CARBON ARC CUTTING AND GOUGING

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Scrap steel shapes containing bolts, rivets, protruding welds, eyes, clips, or other protrusions to be washed

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Earplugs

Soapstone

Tape measure

Pliers

Wire brush

Chipping hammer

DC welding machine, minimum 200 amp for light duty or 600 amp for medium duty

Air carbon arc torch and cable

Selection of carbon electrodes up to $\frac{3}{8}$ "

Compressed air source, minimum 16 cfm at 80 psig for light and medium duty or minimum 50 cfm at 100 psig for heavy duty cutting

Module Examinations

Performance Profile Sheets

MODULE 29205-03 - PLASMA ARC CUTTING (PAC)

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Earplugs

Respirator

Soapstone

Tape measure

Pliers

Plasma arc cutting unit with cutting torch and appropriate gas sources

Scrap steel sheet or plate, 12 gauge to ½" thick

Scrap stainless steel sheet or plate, 12 gauge to ½" thick (if available)

Scrap aluminum plate, ⅜" to ½" thick (if available)

Wire brush

Chipping hammer

Module Examinations

Performance Profile Sheets

MODULE 29206-03 - GMAW AND FCAW – EQUIPMENT AND FILLER METALS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Samples of various types and sizes of electrode wires (labeled)
Examples of welding guns (standard and one- pound spool, if available)
Examples of shielding gas regulator-flow meters (if available)
Examples of wire feeders (if available)
Leather welding gloves
Leather welding jacket or sleeves
Welding shield or helmet
Cutting goggles
FCAW welding equipment
Electrode wire, 0.45" dual shielded flux cored carbon steel
GMAW welding equipment
Carbon steel wire electrode
Shielding gas
Welding bench with arm for position work
Portable angle-head grinders
Framing square
Soapstone
Tape measure
Pliers
Half-round bastard file
Friction lighter
Wire brush
Chipping hammer
Workpiece clamps
Pipe alignment clamps
Pipe beveling equipment (optional)
Module Examinations
Performance Profile Sheets

MODULE 29207-03 - GMAW AND FCAW – PLATE

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Cutting goggles

FCAW welding equipment

Electrode wire, 0.45" dual shield flux cored carbon steel (Class E71T-1)

GMAW welding equipment

Carbon steel wire electrode

Shielding gas

Welding bench with arm for position work

Portable angle-head grinders

Framing square

Soapstone

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Chipping hammer

Workpiece clamps

Module Examinations

Performance Profile Sheets

MODULE 29208-03 - GTAW – EQUIPMENT AND FILLER MATERIALS

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Samples of various types and sizes of electrodes (labeled)

Examples of shielding gas regulators/flow meters (if available)

Examples of welding guns

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Cutting goggles

GTAW welding equipment

Tungsten electrodes

Shielding gas

Welding bench with arm for position work

Module Examinations

Performance Profile Sheets

MODULE 29209-03 - GTAW – PLATE

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Leather welding gloves
Leather welding jacket or sleeves
Welding shield or helmet
Cutting goggles
GTAW welding equipment
Tungsten electrodes
Carbon steel filler metal
Carbon steel plate $\frac{3}{8}$ " thick
Shielding gas
Welding bench with arm for position work
Portable angle-head grinders
Framing square
Soapstone
Tape measure
Pliers
Half-round bastard file
Friction lighter
Wire brush
Chipping hammer
Workpiece clamps
Module Examinations
Performance Profile Sheets

Level Three

MODULE 29301-03 - PREHEATING AND POSTWELD HEAT TREATMENT OF METALS

Overhead projector and screen

Transparencies

Whiteboard/chalkboard

Markers/chalk

Blank acetate sheets

Transparency pens

Pencils and scratch paper

Appropriate personal protective
equipment

Sample welds with proper preheating and postweld heat treatment

Sample welds with defects due to improper preheating or postweld heat treatment

Sample preheating tips for oxyfuel torches

Sample gas preheating torch

Sample temperature-indicating crayons

Sample pyrometer, thermocouple devices, or temperature-sensitive indicators

Module Examinations

MODULE 29302-03 - PHYSICAL CHARACTERISTICS AND MECHANICAL PROPERTIES OF METALS

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Samples of various types of steels, metals, and filler metals

Magnet

Metal analyzer

Module Examinations

MODULE 29303-03 – GAS METAL ARC WELDING (GMAW) – PIPE

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Cutting goggles

Welding bench with arm for position work

Mechanical, plasma, and/or oxyfuel cutting equipment

Gas-shielded GMAW welding machine and gun

Portable angle-head grinders

Framing square

Soapstone

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Chipping hammer

Workpiece clamps

Appropriately sized wire electrode compatible with the base metal being welded

Pipe for weld coupons: 3" to 12" Schedule 40 or Schedule 80 carbon steel pipe

Pipe alignment clamps

Pipe beveling equipment (optional)

Antispatter compound

Module Examinations

Performance Profile Sheets

MODULE 29304-03 – FLUX CORED ARC WELDING (FCAW) – PIPE

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Cutting goggles

Welding bench with arm for position work

Oxyfuel cutting equipment

FCAW welding machine and FCAW-S and/or FCAW-G gun

Portable angle-head grinders

Framing square

Soapstone

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Chipping hammer

Workpiece clamps

Appropriately sized wire electrode compatible with the base metal being welded

Pipe for weld coupons: 3" to 12" Schedule 40 or Schedule 80 carbon steel pipe

Pipe alignment clamps

Pipe beveling equipment (optional)

Hi-Lo gauge

Module Examinations

Performance Profile Sheets

MODULE 29305-03 – GAS TUNGSTEN ARC WELDING (GTAW) – CARBON STEEL PIPE

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Examples of pipe with poor weld profiles

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Cutting goggles

Welding bench with arm for position work

Oxyfuel cutting equipment

GTAW welding machine and torch

Shielding gas

Backing gas

Portable angle-head grinders

Framing square

Soapstone

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Chipping hammer

Workpiece clamps

Appropriately sized carbon steel wire electrodes

Pipe for weld coupons: 3" to 12" Schedule 40 or Schedule 80 carbon steel pipe

Pipe alignment clamps

Pipe beveling equipment (optional)

Module Examinations

Performance Profile Sheets

MODULE 29306-03 – GAS TUNGSTEN ARC WELDING (GTAW) – LOW-ALLOY AND STAINLESS STEEL PIPE

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Examples of pipe with poor weld profiles

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Cutting goggles

Welding bench with arm for position work

Mechanical or plasma cutting equipment

GTAW welding machine and torch

Shielding gas

Backing gas

Portable angle-head grinders

Framing square

Soapstone

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Chipping hammer

Pipe for weld coupons: 3" to 12" Schedule 40 or Schedule 80 stainless, low-alloy, or carbon steel pipe

Low-alloy and stainless steel filler metal

Workpiece clamps

Pipe alignment clamps

Pipe beveling equipment (optional)

Module Examinations

Performance Profile Sheets

MODULE 29307-03 – GAS TUNGSTEN ARC WELDING (GTAW) – ALUMINUM PIPE

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Examples of pipe with poor weld profiles

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Welding bench with arm for position work

Mechanical or plasma cutting equipment

GTAW welding machine and torch

Shielding gas

Backing gas

Portable angle-head grinders

Framing square

Soapstone

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Chipping hammer

Workpiece clamps

Aluminum pipe for weld coupons: 3" to 12" Schedule 40

Aluminum filler metal compatible with the base metal being welded

Pipe alignment clamps

Pipe beveling equipment (optional)

Module Examinations

Performance Profile Sheets

MODULE 29308-03 – GAS METAL ARC WELDING (GMAW) – ALUMINUM PLATE AND PIPE

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Examples of pipe with poor weld profiles

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Welding bench with arm for position work

Mechanical or plasma cutting equipment

GMAW welding machine and gun

Shielding gas

Backing gas

Portable angle-head grinders

Framing square

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Workpiece clamps

Appropriately sized aluminum wire electrode compatible with the base metal being welded

Aluminum plate for weld coupons: $\frac{1}{4}$ " to $\frac{3}{4}$ "

Aluminum pipe for weld coupons: 3" to 12" diameter Schedule 40

Pipe alignment clamps

Pipe beveling equipment (optional)

Module Examinations

Performance Profile Sheets